Usability Testing of an Audio Computer-Assisted Self-Interview (ACASI) Instrument for the National Health Interview Survey (NHIS): Final Report

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Introduction

This report summarizes the findings of usability testing to evaluate an Audio Computer-assisted Self-interview (ACASI) instrument developed by the Questionnaire Design Research Laboratory (QDRL) at the National Center for Health Statistics (NCHS) for the National Health Interview Survey (NHIS). The main goal of this usability testing was to develop a system that allowed the maximum number of users of ACASI to successfully complete the survey with as few errors as possible and to assess respondents' experience using the instrument. The following section outlines the usability testing and describes how analysis of the data was conducted. The final section of the report provides a detailed analysis of the results.

This report focuses on the usability of an ACASI instrument for the NHIS, stemming from a project to develop a revised question to measure sexual identity. Testing and revision of a sexual identity question was necessitated by high missing data rates in other NCHS surveys including the National Survey of Family Growth (NSFG) and National Health and Nutrition and Nutrition Examination Survey (NHANES). In examining the missing data analysts found that the missing data rates were not equal across all subgroups. For example, in the 2002 NSFG the missing data rate among males with less than a high school degree was 11.4 percent, while male respondents with an education above a high school degree had a missing data rate of only 2.1 percent. In addition to revising the sexual identity question, NCHS wanted to change the mode of administering the question to ACASI to provide more privacy to respondents, under the assumption that this would result in more accurate data. This belief stems from a number of studies that have found that administering potentially sensitive questions in an ACASI mode provides higher reporting of behaviors (Tourangeau and Smith 1996; Adimore, Schoenbach, and Taylor, et al. 2011). However, while ACASI would likely improve data quality, it would also increase the burden for the respondent and interviewer. In its current format, the NHIS interview is already long, and by adding an ACASI component onto the current interview would likely increase the interview length, potentially increasing breakoff rates. Additionally, interviewers

are currently required to carry a set of materials that include: a binder with business cards, an NHIS brochure, an advance letter, a government ID, a laptop, and a binder with show cards. Taking all of these factors into account, QDRL staff worked to design an ACASI instrument that could be implemented using the current data collection software (Blaise) and laptops, while also minimizing the time needed to make the transition from the CAPI instrument to the ACASI instrument. This report summarizes the findings from this testing.

Methodology

Testing of the ACASI instrument consisted of both cognitive interviewing and interviewer observations. Cognitive interviewing is the primary method used by the federal statistical system in the United States to ensure data quality. Cognitive interviewing is a qualitative method that provides rich data about the way that respondent's comprehend a question, retrieve the relevant facts or information, and then map this information onto the response options provided. In the context of usability testing, cognitive interviewing permits the understanding of features or tools that a respondent utilized as well as the thought process used to complete the questionnaire.

QDRL ultimately conducted 139 cognitive interviews: 93 in English and 46 in Spanish. These interviews were conducted on-site at the QDRL interview lab in Hyattsville, Maryland as well as at several off-site locations including The DC Center for the LGBT Community, Mpoderate (a center for Latino gay male and transgender youth), Casa de Maryland, and a rented office building located in the Colombia Heights neighborhood in Washington, D.C. English speaking respondents were recruited through the QDRL database, newspaper advertising, flyers and by word-of-mouth. Spanish speaking respondents were recruited through flyers, by word-of-mouth, and with the assistance of several non-profit organizations catering to the Latino community.

Table 1 presents respondent demographics for the study. An attempt was made to capture a broad range of respondents; however, given the questions being tested a particular emphasis was placed on recruiting gay and lesbian respondents as well as a range of those reporting 'something else' including, those who identify as transgender, queer or who are still in the process of figuring out their sexuality.

Table 1. Respondent Demographics

Interviews Completed:	**139**	
	Count	**Percentage**
Gender		
Male	65	46.8%
Female	66	47.5%
Its More Complicated	8	5.8%
Sexual Identity		
Straight	86	61.9%
Gay or Lesbian	24	17.3%
Bisexual	9	6.5%
Something Else	19	13.7%
Education		
Less than HS degree	23	16.5%
High School Degree/GED	38	27.3%
Some college, no degree	22	15.8%
Associates Degree	17	12.2%
Bachelors	21	15.1%
Graduate School	17	12.2%
Race		
White	32	23.0%
Black	62	44.6%
Indian American	7	5.0%
Asian	4	2.9%
Other	18	12.9%
Latino	49	35.3%
Language		
English	93	66.9%
Spanish	46	33.1%
Age		
Under 25	21	15.1%
26-40	45	32.4%
41-60	48	34.5%
Over 60	16	11.5%

Interviewing Procedures

Respondents were scheduled for specific interview times (with the exception of a few "drop-ins") and reported to a set location for their interview. Interviews lasted between 30 and 90 minutes with the typical interview lasting from 45-60 minutes. All interviews were audio

recorded using both a cassette recorder as well as a sound recording program on the computer. Respondents were asked to check an anonymous consent form before the interview began and were also asked to give their oral consent once the taping began. At the conclusion of the interview all respondents were given $50 as remuneration.

At the beginning of the interview, respondents were told that they were going to be answering a few questions on the computer and that the computer would provide instructions on how to complete the questionnaire. During the interview, interviewers encouraged respondents to solve any questions or confusion on their own, but if it became clear that a respondent was unable to resolve the issue the interviewer would intervene to ensure completion of the questionnaire. This method was implemented to replicate the methods used by field interviewers in the NHIS. Once the respondent completed the questionnaire, interviewers asked about a respondent's comfort with computers and technology as well as determine their computer usage at home and work. This information was then used along with the interviewer's observations to probe about a respondent's experience completing the ACASI questionnaire. Typical probes used to ask respondents about their experience included, "How did you learn to answer the questions?" or "What would have made the experience easier for you?" Respondents were also asked to recall the keys on the computer that they used. Additionally, if a respondent had any difficulty they were asked to verbalize what they saw and how this differed from what they expected or were looking to see.

Data Analysis

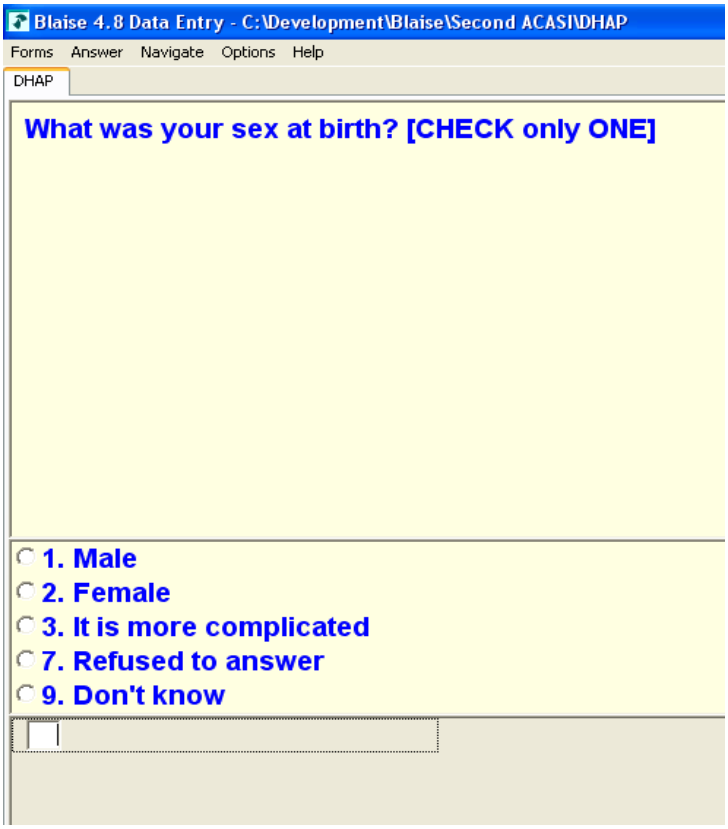
Data from the interviews were analyzed using qualitative techniques, specifically, the constant comparative method (Glaser and Strauss, 1967; Corbin and Strauss, 1990; Ridolfo and Schoua-Glusberg 2011). Analysts used Q-Notes, an analysis software tool developed by the Questionnaire Design Research Laboratory (QDRL) at the National Center for Health Statistics for analyzing cognitive interview data. As data were entered into the Q-Notes software, the causes of respondent difficulties using the ACASI system were identified.

After interviews were conducted, more intensive analyses were conducted so as to more systematically evaluate the usability of the ACASI and review the causes of difficulties. The first step of data analysis involved reviewing the data and identifying types of problems as well as the categories that made up each type of problem. For example, a respondent's experience using a computer was identified early on as an important analytic theme, and the categories underneath this theme reflected four different levels of experience with a computer. Categories were created as new issues were discovered. Additionally, we examined the relationship of the themes and categories to each other. These core themes served as the unifying link between all patterns and denoted a working theory that depicts the patterns. For this project, a problem was defined as any time where a respondent was unsure of what they should do or any time a respondent selected an answer they did not intend to select.

ACASI Development

The software available for development was the ACASI instrument that is a component of Blaise. The standard interview layout allows only one audio file per question which means that the computer plays the question, followed by instructions to select a response option. Respondent must read or remember which number corresponds to their intended answer and enter the number in the box provided. Audio can be repeated, but the respondent will hear the question and all responses again. The image below shows the initial Blaise screen shot as the starting point for software development.

Image 1. Initial Blaise Screenshot example



This version requires training and provides little to no instructions to participants. Therefore participants need to be literate or have a good memory since in order to answer the questions they have to remember the choice they want to select, enter the corresponding number in the box provided, and be comfortable using a keypad.

Based on the field observations of the NHIS interviews during the Fall 2010 QDRL staff developed a first version of the ACASI questionnaire with customized Blaise software that addressed some of the concerns listed above. This included, removing the field pane expanding text, adding picture instructions, and only displaying one picture or play audio at a time so respondents can go back and play the responses again.

We performed seven rounds of usability testing of the English version of the ACASI system and three rounds of usability testing of the Spanish version of the ACASI system. For the purposes of this report, the concept of usability is defined as the respondents' ability to answer survey questions without any or minimal response error produced by problems with the technology. A central piece of the usability testing for this questionnaire are the instructions generated by the testing team and how these instructions helped facilitate the interaction between the respondent and the laptop.

Summary of Findings

The goal of this project was to develop an ACASI software application that a nationally representative sample could learn to use with minimal instruction. Additionally, this needed to be done using the current hardware and software used by NHIS field interviewers. We developed such a software application through an iterative approach. After a number of alterations to the initial Blaise ACASI program, we developed a program that a majority of respondents were able to quickly learn to use without any assistance from interviewers. Additionally, the small number of respondents who did need assistance required only minimal guidance.

In the process of improving the basic Blaise ACASI application the introduction screens were minimized and consequently we found that very little time was needed for respondents to learn to use the ACASI instrument. We learned through this iterative process that instructions should be simple, consist of symbols rather than words, and be limited in length. By implementing these changes to the initial instrument, we were able to reduce response errors caused by usability issues with the ACASI software. While we were ultimately able to design a revised ACASI instrument that could be used by the majority of respondents with a minimal amount of training, the "Mark all that apply" questions presented a challenge. Despite trying many different formats, we were ultimately unable to design a format that the majority of respondents were able to use due to the added complexity of the question format.

The remainder of this report is an in depth examination of the changes implemented that improved the usability of the instrument.

Findings

Usability

Overall, our testing focused on the instructions provided to the respondent in utilizing the ACASI instrument to improve the usability. We ultimately conducted several rounds of testing with the ACASI program, making minor improvements and alteration each time, before settling on a final version. The instructions were developed through an iterative approach, meaning that following a round of testing the instructions were reviewed and modified. The modified version, then, was further tested in an additional round. In each round of testing we identified problems with instructions or the structure of the ACASI instrument. In the conclusion we provide a

suggested version of the introductory screens that resolves problems identified during early rounds of testing.

The usability issues found in this project can be categorized into four general areas: instructions which refers to trouble using keys to select answers and finding keys on the keyboard and understanding or following instructions; laptop uses refers to respondents using mouse touch screen or voice recognition instead of keyboard to attempt to select response; fear/apprehension refers to respondents anxiety of doing something wrong and breaking the computer. Usability challenges can be characterized in three main areas: first in the general area of instructions, second the ways in which respondents utilize the laptop, and third the problems that respondents had with the mark all that apply question. These usability challenges were evident in English and Spanish.

Based on observations of respondents' interactions with the ACASI instrument and direct probing about their computer usage, comfort with computers, and amount of usage; four groups of "computer literacy" levels emerged:

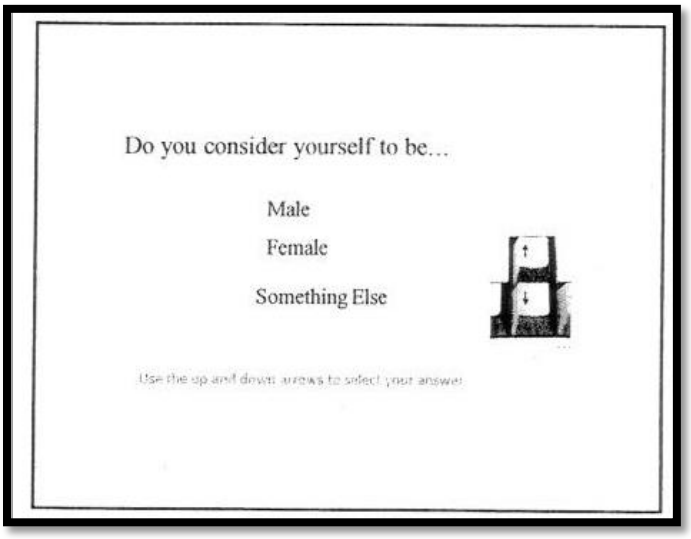
1. Never used computer: Respondent has had no contact with computer.
2. Minimal user: Respondent has used a computer, but has minimal contact with computer and need generally needs substantial support to use a computer.
3. Intermediate user: Respondent has contact with a computer at least a few times per week. Intermediate users are able to use a computer for basic tasks including word processing or internet browsing.
4. Experienced user: Respondent uses computer daily both at work and home and is able to troubleshoot and fix minor issues with the computer.

Of the 139 respondents three (2.2%) had never used a computer, thirty six (26%) were minimal users, twenty three (17%) were somewhere in between, and seventy-two (52%) were experienced users.

Round One, English

The first round of testing included a brief introduction that told respondents the keys that they would be using (the arrow keys to circle their answer, the space bar to select their answer, and the enter key to move to the next question). Each screen included instructions and an image of the keys respondents needed to press to select their answers. Respondents were instructed to use the up and down arrows to toggle through the response options, the space bar to select a response, and the enter key to move to the next screen. Additionally, respondents had to input numbers for their age in the first question. A total of 12 respondents were included in round one of testing.

Image 2. Screenshot example round 1



The image above shows an example of a question of Round 1. All respondents in this round of testing had usability problems, more than half of the respondents (7 out 12) had trouble using the keys on the keyboard, for example a number of respondents were unsure of what the "arrow keys" were. One respondent when instructed to press enter, sat with a blank stare because he was unsure what the enter key was. When the interviewer asked him if he had to guess what button was the enter key, he pointed to the screen. In general respondents found themselves confused and not knowing what keys to press to choose an answer, move around the screen, or move to the next screen. Additionally, we also discovered that some respondents read the questions on the computer, while others relied on the computer to read the questions aloud. One respondent explained that he relied on the computer to read the question, "Because sometimes I think when you read stuff you misunderstand what their saying, but when they speak it to you, you know exactly what their saying."

Round Two, English

In round two, we introduced color coded the keys, rather than relying on computer terms, given that those with little or no computer experience, the names of keys (e.g. 'the tab key' and 'the enter key') were often unknown. With this change, we also decided to remove the instruction screens, and instead provide the instructions on the screen with the question. This meant that as soon as the respondent ID number was entered the computer read the first question and its response options and then provided the instructions on how to enter their answer. Thirteen respondents were included in round two of testing.

Two respondents did complete the questionnaire without any error. After these changes, some respondents were able to complete the questionnaire without difficulty. One respondent who only occasionally uses a computer at a local recreational center explained that she was able to complete the questionnaire "because of the instruction of the colors". This respondent also sometimes has difficulty reading due to her "bad eyes", and without probing stated that she liked

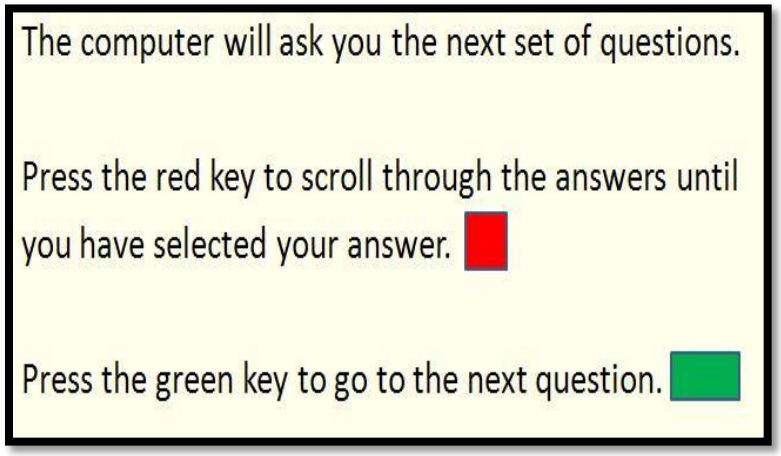
the large font which made it easy for her to use. Another respondent who said she only uses a computer to play solitaire stated, "I just don't know how to use a computer but it was easy enough. Because you already had the buttons labeled with the red, green, and yellow… that helped."

Nonetheless these changes did not increase the usability for all respondents. Over half of the respondents (62%) still had problems using or finding the appropriate keys in this round of testing, and half of the respondents had trouble understanding the instructions provided. A new problem that emerged during this round of testing was the desire of respondents to use the mouse to complete the questionnaire. Four of the 13 respondents in this group attempted to use the mouse, rather than the required keys. Additionally, two respondents tried to respond to questions verbally as if the computer had a voice recognition system. For example one respondent, when the question was read aloud he simply said "I'm married." Then when he pushed the key to tab through the answers, the computer began reading the answers aloud which confused the respondent and caused them to select an incorrect answer.

Round Three, English

As part of the iterative process, we analyzed the data while engaged in testing. During the interviews, a number of respondents expressed the need for some introductory material either from the interviewer or the computer. For this reason, in Round 3 the introduction screen was added again. These instructions were simple and short with the goal of allowing comprehension for those with low literacy and all the necessary information to select answers. Below is the screenshot of the introduction screen.

Image 3. Round 3 Instruction Screen

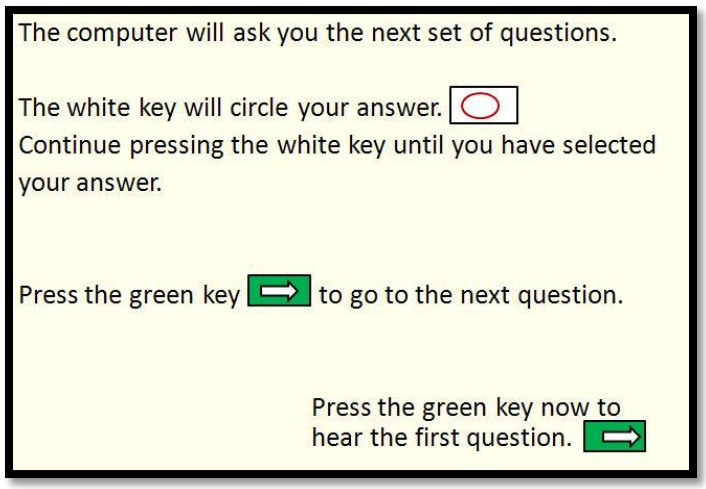


This round of testing included eight respondents. Results in this round did improve as compared to the previous round, although some usability problems remained. Of note, half of the respondents had trouble finding and using the keys on the keyboard and half of the respondents had trouble understanding the instructions.

Round 4, English

In order to address the problems stated above changes were introduced in Round 4. These changes sought to address problems without increasing the number of screens at the start of the ACASI portion of the interview. We introduced the use of symbols combined with colors to help respondents better identify keys on the keyboard and make instructions easier to understand as shown on image 3 below. A total of nineteen respondents were included in this round of testing.

Image 4. Round 4 introduction screen.



This round of testing showed improvements in usability, four respondents in this round successfully complete the protocol without problems. None of the respondents attempted to use the screen as a touchscreen or respond to the questions verbally, effectively eliminating these two problems. However seven out of 19 respondents had trouble with the instructions and the use of the keys (37%) and two respondents still attempted to use the mouse to click on the responses. Additionally, a quarter of respondents expressed apprehension when faced with the computer. For instance,

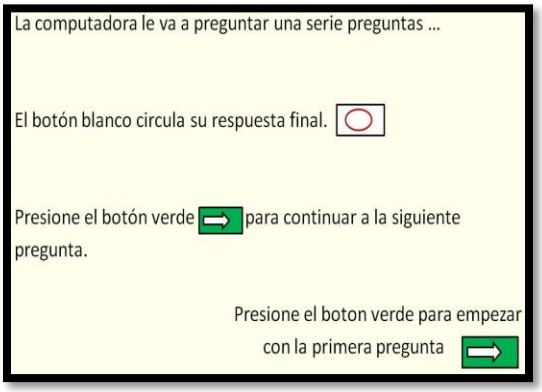
> R: I'm used to using a mouse to click and select multiple choices not having to hit enter, enter, enter until you get to the correct one. It made me panic …
> Interviewer: it made you panic just because?
> R: when it wanted my age I was like am I going to be able to use numbers? Am I going to have to type or am I going to have to hit it 25 times? [Taps finger on the table]
> Interviewer: so it made you panic? Did you find it stressful or easy?
> R: not challenging because I'm very computer literate so I knew that I could just watch it, but maybe too much computer familiarity made me expect to simply be able to pick up the mouse and press enter …

While this user is comfortable with computers and uses them frequently, the fact that she was forced to use the computer outside of her normal methods made her apprehensive. This issue because a common pattern among experienced users in this round.

Round One, Spanish

Round One in Spanish and Round Four in English provided the first opportunity to test the cross-cultural bilingual model of cognitive interviewing. We conducted parallel testing with interview protocols that tested the same questions in similar conditions, allowing us to test usability of the instrument and the technology and control for other factors such as location, interviewer bias, and quality control. Twenty Spanish speaking respondents were included in this round of testing. Below is the introduction screen in Spanish.

Images 5. Spanish Language Introduction screen



In the first round of testing in Spanish one of the twenty respondents successfully completed the protocol without problems. This respondent was a minimal computer user in her 50's, she uses the computer to listen to the radio, email, and video chat; however, she had little comfort with computers. Her interviewer noted:

> Respondent reported she felt the instructions were easy to understand. Respondent recalled directions as the green button to continue and the white button to select the option for the question … Respondent listed to all options and the question and directions before making a selection for all the questions. Respondent did not have a problem making use of the keys in the keyboard and moved smoothly through the survey.

According to the respondent, the reason she was able to successfully complete the questionnaire is because she listened to the instructions. Eighteen out of the 20 respondents (90%) had trouble using the keys on the keyboard. Four of the twenty respondents had problems completing the *Mark all that Apply* question, for example an interviewer noted:

> At first he [respondent] tried to type in his answer using the keyboard and spelling it out. He then tried to use the mouse. He also tried to use the mouse on question two. On question three he began to understand that he needed to use the keypad. He then did OK until the race [mark all that apply] question at which point he could not figure out to hit the yellow button. He eventually just gave up after three times getting the prompt that he had not yet selected an answer. He said that the experience was very frustrating. He said he is used to typing and that using the keyboard in this way didn't make sense to him. He said that pressing buttons caused too many problems.

Some respondents had trouble connecting the instructions on the screen with the keyboard and as a result they used the mouse to click on answers. Half of the respondents tried using the mouse, while three respondents tried to use the screen as a touch screen and two respondents attempted to complete their answers by voice recognition or typing in the answers. Of the 20 Spanish speaking respondents 8 of them had less than a high school education and four of them had only elementary school education, making these respondents actively illiterate.

Respondents with the lowest levels of education also reported basic computer literacy and expressed anxiety when faced with the laptop computer to complete the ACASI questionnaire. Four respondents in this round expressed some level of fear or apprehension about computers. For instance this respondent is a 32-year old Latina immigrant with a 4th grade education and minimal computer knowledge. Her interviewer noted:

> At first, on the introduction screen, she tried to press the buttons on the actual screen. Then she tried to answer verbally. Finally I had to explain to her to use the buttons on the keyboard. On the first question she did OK. Then on the second question she didn't understand to press the green button to advance to the next question. On the third question she did not understand to press the white button to advance down the options. Then she also still did not get to hit the green button. She kept asking me questions throughout about which answer she should select given her situation and I replied that she should choose the one that she feels best describes her … During probing she said that the survey was not difficult but that she doesn't know how to use the computer. She said she has almost never used a computer. She will sometimes get on the computer at her friend's house to use Facebook but that is maybe once a month at most. She said even for that her friend has to help her. She said that the colors on the keyboard didn't help her understand how to do it. She said the voice helped … and that she listened to the voice and read too.

The respondent struggled to use the ACASI format that required her to identify keys on a keyboard to enter her responses and understand how to use the computer on her own. As other respondents who utilized similar methods to complete the questionnaire, this respondent attempted to use technology in ways that made sense to her, e.g. touch screen.

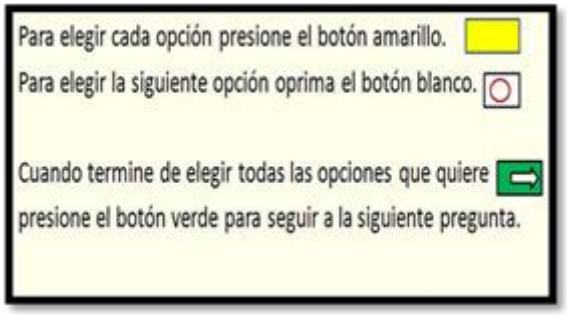
Round Two, Spanish

Round two of Spanish testing involved the same introduction screen as the previous round; the main improvement involved fixing skip patterns in the programming. Eight respondents were included in the testing for this round. In this round one respondent completed the questionnaire without problems. His interviewer noted:

> The respondent had no usability problems whatsoever. They [sic] hit the white button to select their answer and the green button to go to the next question … They [sic] finished the interview in 2:40 so they were also able to navigate it rapidly … He has a computer

and the internet at home. He feels comfortable using computers. He learned to use computers in high school. Respondent thought that taking the survey would be difficult but after starting realized that it wasn't. He said the buttons were all clear and that the voice helped him to understand what to do ... He said the instructions were clear and that he did not find any part confusing.

Image 6. Mark all that Apply Instruction screen Spanish



Thirty percent of respondents had usability problems in Round 1 with the *mark all that apply* question, in Round 2 seventy-one percent experienced problems inputting and selecting responses for this question. Two respondents tried to use the mouse to select answers, for example one interviewer noted:

> Respondent started by trying to use the mouse on the first screen. Respondent was told that he could not use the mouse as an option. The Respondent just sat there and shook his head. Respondent sat looking at the screen for a while, maybe a couple of minutes. Interviewer asked Respondent what options he had to move forward … Respondent said it wasn't possible to move forward without using the mouse. The Respondent said that maybe he can use some other keys on the keyboard but still appears to not see the marked keys. He states that maybe he can use the control, arrows, and escape keys and attempted to use these unsuccessfully. After another silence interviewer asked the Respondent if he sees a connection between the screen and the keyboard it was then that the Respondent looked at the keyboard and saw the green button and pressed it to go forward.

Similar to other respondents who tried using the mouse to navigate the instrument, this respondent had trouble making the connection between the instructions on the screen and the keyboard in front of him. In this round two of the eight respondents attempted to use the computer as a touch screen and four of the eight as a voice recognition system.

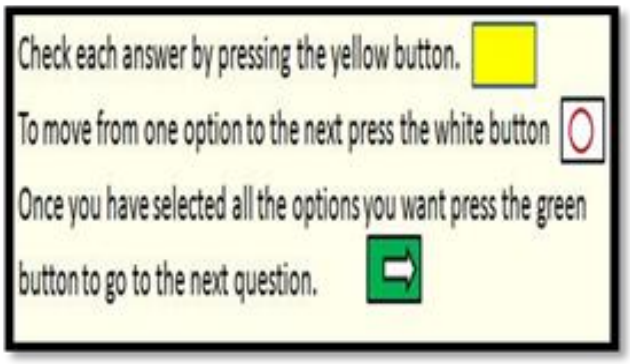
<u>Round Five, English</u>

Round 5 of English testing included fixing skip patterns in the programming and changes to the order of some of the selections for options in the questions. This round of testing saw marked usability improvements. Nine of the twenty one respondents had no problems

answering the questionnaire. Of those who had no usability problems four were minimal users, three fit into the in-between category, while 5 were experienced users. A respondent who was reasonably comfortable with computers said, "It was pretty much clear on how to use the machine. Of course you have the different components that you would use.. the white key, the yellow key, the green key. That was easy enough… If these things weren't on here then it probably would have been harder. I think, I don't know, this would have been tab, and enter, space bar." While this user seemed to know the computer terminology, she did not seem confident about her knowledge of computers and in fact said, "If you don't know anything, or even if you know a little bit then you could get confused." Another minimal user who uses a computer roughly twice a month explained, "Once you get the hang of it, it's just like riding a bike." This user also said that "due to the color coding" he was able to easily complete the survey.

Four of the respondents had trouble using the keys on the keyboard and three had trouble understanding the instructions. The usability problems for the *mark all that apply* question remained high at 38% in this round, although it was significantly reduced from Round 1 in which the all respondents had usability problems.

Image 7. Mark all that Apply Instruction screen



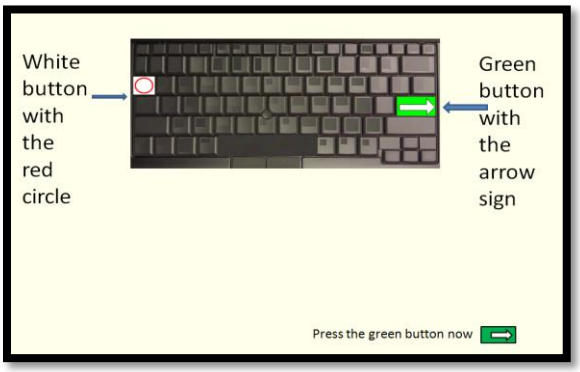
The reduction of usability problems can be attributed to better instructions or a combination of an increase number of respondents who are experienced computer users; in Round 5, twelve of twenty-one respondents were experienced computer users (57.1%). At this point there is not enough evidence to determine which factor, computer experience or instructions, created improved usability.

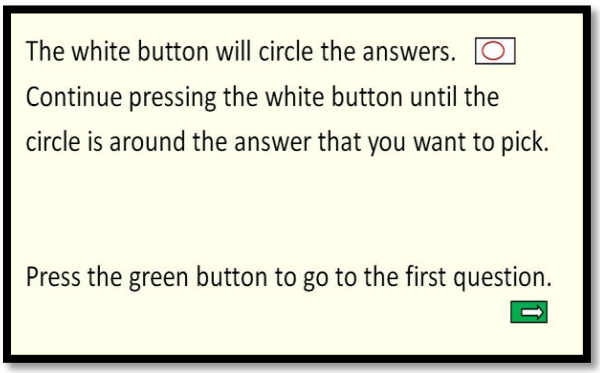
Round 6, English

In this round we sought to address the challenge of respondents' inability to connect the images and instructions on the screen with the keyboard. To address this problem, we reduced the text on the screen and added an image of the keyboard to the instruction screen which served as a visual link between the screen and the keyboard. In addition we changed the script of the audio to sound more familiar and accessible – less "computer like" – from "the computer will

ask you a set of questions" to "I will ask you a set of questions." A total of twelve respondents were included in this round of testing. The results are the screens below.

Images 8 and 9. Instruction screens Round 6, English





In Round 6 we targeted our recruitment on LGBT respondents due to the questions being tested. This resulted in respondents this round being more computer literate and all but one respondent had attended some college.

Usability significantly improved for users in this round of testing, eleven out of the thirteen respondents completed the questionnaire without problems. Two respondents had problems using the keys on the keyboard and one out of the thirteen users appeared hesitant and asked questions in regards to what keys to use in order to select answers. During the usability testing this respondent explained what caused the confusion:

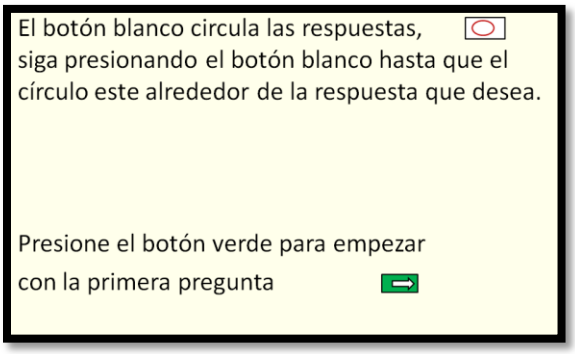
> Interviewer: overall how do you think that went?
> R: that was easy (giggles)
> Interviewer: ok … at first you had a little bit of trouble figuring out what keys you should be using and if you should use the arrows
> R: it actually explained that but I wasn't sure and I was afraid that if I pushed I would select the wrong one so, what if I select the wrong one? You probably take it back to … I don't know (laughs nervously)
> Interviewer: I see what you are saying
> R: I was trying to figure out how to toggle to … because the square button was down here and I thought it said push this until you get the right answer but it seemed to me that you use the arrows to move it …it was a little bit confusing to select the one that you wanted selected to get it selected.
> Interviewer: do you think that is because you are used to using the arrows to select things
> R: probably, yeah

Part of the reason why the usability improved so significantly in this round and the subsequent rounds is the removal of the *mark all that apply* (race) question and the improved design in the introduction screens (see images above).

Round Three, Spanish

Round Three in Spanish incorporated changes to the instruction screens similar to the ones made in Round Six in English. These changes were designed to help the lowest literacy respondents by simplifying the language and addressing grammatical concerns over the translation in order to clarify the intent of the questions. For the sexual identity question we added the option of "heterosexual, o sea no es gay." Nine Spanish speaking respondents were included in this round of testing. Below are images of the introduction screens

Images 10 and 11. Introduction Screens Spanish Round 3

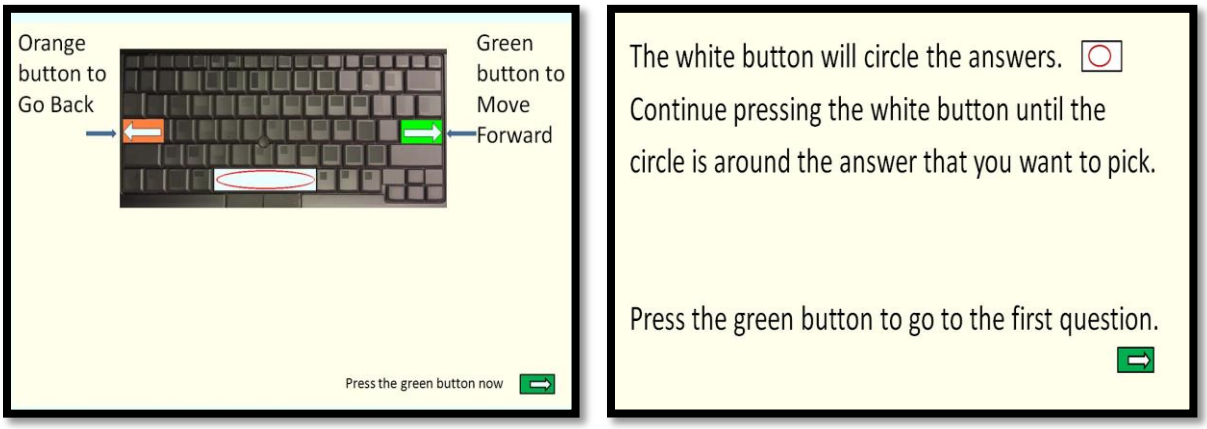


This round of respondents can be characterized as more educated and computer literate than the previous rounds of Spanish speaking respondents; twelve out of seventeen attended at least some college and of those five attended graduate school. Three respondents attended high school and two attended only elementary school. Twelve out of the 17 respondents had no usability problems. Of the five respondents that had usability problems two attended technical school and earned some sort of certification, one had a high school diploma, and two had attended up to the sixth grade. The usability problems in this round centered on trouble understanding the instructions, and finding the keys on the keyboard. In addition one respondent tried to use the screen as a touch screen, one respondent spoke the answers out loud attempting to use the computer with voice recognition, and one expressed anxiety when faced with the computer.

Round Seven, English

In this last round we recruited older (70 + years old) respondents targeting a population that we had not captured in the previous testing. The main change in this round was the introduction of the back button. This function allows the respondent to go back to the previous screen to change, review, or answer the question. The instructions continued to be simple and included an image of the keyboard as a visual aid.

Images 12 and 13. Introduction Screens English



Five respondents had trouble finding and using the keys on the keyboard and four respondents had trouble with the instructions. In addition three respondents expressed anxiety and fear in terms of using the computer, for example an interviewer noted about the respondent:

> She has very little computer experience, to the point that she is a little bit afraid of computers. Respondent used the computer for work, but found it to be very uncomfortable. Part of this discomfort with computers stems from the fact that respondent had a stroke and is partially paralyzed in her left hand, which makes it hard for her to type. Respondent said that she does have a computer at home but avoids using it whenever she can and says that she primarily uses it for internet related tasks (i.e. email and looking something up). Respondent says that she simply is not a good typist, so for most of her tasks she solely uses the mouse.

While a higher number of respondents in this round had difficulty with the ACASI system, respondents were generally able to solve their own problems and complete the questionnaire. It is also important to note that the anxiety that disabled and/or elderly respondents may feel is different than other respondents. This unique apprehension exhibited in this group could explain the higher number of respondents who had difficulty but we still able to finish the questionnaire.

<u>Mark all that Apply Questions</u>

At the outset of testing, a race question was included that allowed respondents to select multiple response options. This type of question posed a unique challenge as respondents would need to be able to tab to the appropriate response option, then select multiple options, and then push a button to move to the next question. Throughout our testing, we found that respondents struggled with this format.

After Round 5, English and Round 2, Spanish the decision was made to remove the race question. Part of the decision to remove this question is because we were unable to design a question that provided a real solution to the problem; we only provided partial solutions in handling the data entry. Since dealing with the issue of a question with ark all that apply option

was not the focus of this study the decision to remove the question was made since it distracted from the main focus of the study.

Conclusions and Recommendation

The final version that we recommend for use in ACASI is designed to cater to those respondents with low literacy and low socio-economic status at the same time the instructions are short and simple for those who do not want to sit through extensive training. The screens use symbols instead of words to help respondents navigate the questionnaire. It must be underlined that literacy is measured not only by educational attainment, the National Assessment of Adult Literacy, measures English literacy by "how adults use printed and written information to adequately function at home, in the workplace, and in the community" (National Assessment of Adult Literacy 2011), therefore respondents who have attended only high school may have problems understanding and comprehending some of the terminology used in surveys. Among U.S. adults age 16 and older it's estimated that 93 million have Basic and Below Basic literacy skills[1] (National Assessment of Adult Literacy 2011). The goal of the QDRL team was to develop an ACASI system using an iterative approach that catered to a population with low literacy through a novel new approach. We did this through studying how people use technology when they have to use it instead of relying exclusively on expert opinions for design. What we found was that individuals wanted simple instructions. We created a program catering to these needs. The main changes and findings for this study are:

In order to achieve a self-administered questionnaire, we implemented a number of changes to the original Blaise program that enhanced the usability for respondents with low literacy levels. One of the biggest changes implemented was the use of color coded keys to navigate, rather than relying on computer terminology (i.e. enter key) or complex instructions for the respondent. A number of respondents, particularly respondents with little computer experience, commented that the color scheme helped them to navigate the program. Overall respondents were able to quickly learn to use this program in a short period of time with limited interviewer interaction, which maximizes the impact of the ACASI format over interviewer administration. Additionally, the revised program added functionality to have the response options read aloud as the respondent tabbed through. This allowed respondents with low literacy to easily hear the response options again and confirm that the option they were selecting was the option that they intended.

[1] Based on 2003 data.

Appendix A

English Version
Cognitive Interviewing Protocol Round 1

Introduction to the Cognitive Interview:

Next, we are going to go back through the questionnaire and talk about how you interpreted these questions. I am interested in knowing how you understood certain questions, interpreted certain words, and whether any of them were difficult to answer.

Do have any (more) questions? (If no questions) OK, let's begin.

1) **How old are you?** Type your age using the numbers on the computer.
_____ years old.

1R) You did not enter an answer for the question. That is because:
You made a mistake and would like to answer
You do not know the answer
You do not want to answer

2) Do you consider yourself to be Hispanic or Latino?
Yes
No

2r)You did not enter an answer for the question. That is because:
You made a mistake and would like to answer
You do not know the answer
You do not want to answer

3) **What race or races do you consider yourself to be?** Please select 1 or more of these categories.
White
Black/African American
Indian (American)
Alaska Native
Native Hawaiian
Guamamian
Samoan
Other Pacific Islander
Asian Indian
Chinese
Filipino
Japanese
Korean
Vietnamese
Other Asian
Some other race

3R) You did not enter an answer for the question. That is because:
You made a mistake and would like to answer
You do not know the answer
You do not want to answer

4) Do you consider yourself to be…
Male
Female
Something else (Go to 4a)

4R) You did not enter an answer for the question. That is because:
You made a mistake and would like to answer
You do not know the answer
You do not want to answer

4a. [If something else is selected] By <u>something else</u>, do you mean that…
You have both female and male genitalia
You are transgender (Go to 4b)
You made a mistake and did not mean to pick this answer
You mean something else (Go to 4c)

4aR)You did not enter an answer for the question. That is because:
You made a mistake and would like to answer
You do not know the answer
You do not want to answer

4b. [If something else/transgender is selected]Are you…
Male to Female Transgender
Female to Male Transgender
You made a mistake and did not mean to pick this answer

4br) You did not enter an answer for the question. That is because:
You made a mistake and would like to answer
You do not know the answer
You do not want to answer

4c. [If something else/Meant something else- What do you mean by something else?
Please type your answer _____

5) Are you now…
Married
Widowed
Divorced
Separated
Never Married
Living with a partner

5r) You did not enter an answer for the question. That is because:
You made a mistake and would like to answer
You do not know the answer
You do not want to answer

6) Are you currently…
Working for pay at a job or business
Working, but not for pay, at a family-owned job or business

With a job or business but not at work, for example, on sick leave
Looking for work
Not working and not looking for work

6R) You did not enter an answer for the question. That is because:
You made a mistake and would like to answer
You do not know the answer
You do not want to answer

7) What is the highest level of school you have attended?
I never attended school
Elementary School
High School
College or Technical School

7R) You did not enter an answer for the question. That is because:
You made a mistake and would like to answer
You do not know the answer
You do not want to answer

7a) What is the highest level of school you have completed?
1st grade
2nd grade
3rd grade
4th grade
5th grade
6th grade
7th grade
8th grade

7aR) You did not enter an answer for the question. That is because:
You made a mistake and would like to answer
You do not know the answer
You do not want to answer

7b) What is the highest level of school you have completed?
9th grade
10th grade
11th grade
12th grade, no diploma
GED or equivalent
High School Graduate

7bR) You did not enter an answer for the question. That is because:
You made a mistake and would like to answer
You do not know the answer
You do not want to answer

7c) What is the highest level of school you have completed?
Some college, no degree
Associate degree: occupational, technical or vocational program
Associate degree: academic program
Bachelor's degree: BA, AB, BS, BBA
Master's degree: MA, MS, MEng, Med, MBS
Professional School degree MD, DDS, DVM, JD
Doctoral degree: PhD, EdD

7cR) You did not enter an answer for the question. That is because:
You made a mistake and would like to answer
You do not know the answer
You do not want to answer

[Male version question]

8) Do you think of yourself as:
Gay, homosexual or Same-Gender-Loving
Straight or Heterosexual, that is, not gay
Bisexual
Something Else (Go to 9a)
Don't Know (Go to 9b)

9R) You did not enter an answer for the question. That is because:
You made a mistake and would like to answer
You do not know the answer
You do not want to answer

9a. [If something else is selected] By <u>something else</u>, do you mean that…
You are not straight, but identify with another label such as queer, trisexual, omnisexual or pan-sexual
You are transgender or are transitioning genders
You have not or are in the process of figuring out your sexuality
You do not think of yourself as having a sexuality
You personally reject all labels of yourself
You made a mistake and did not mean to pick this answer
You mean something else (Go to 9c)

9aR) You did not enter an answer for the question. That is because:
You made a mistake and would like to answer
You do not know the answer
You do not want to answer

9b. [If don't know is selected] By <u>Don't Know</u>, do you mean that…
You don't understand the words
You understand the words, but you have not or are in the process of figuring out your sexuality
You mean something else

9bR) You did not enter an answer for the question. That is because:
You made a mistake and would like to answer
You do not know the answer
You do not want to answer

9c. [If you mean something else is selected]
What do you mean by something else?
Please type in your answer _____

[Female Version Question]

8) Do you think of yourself as:
Lesbian, Gay or Homosexual
Straight or Heterosexual, that is, not gay
Bisexual
Something Else (Go to 10a)
Don't Know (Go to 10b)

10a. [If something else is selected] By <u>something else</u>, do you mean that…
You are not straight, but identify with another label such as queer, trisexual, omnisexual or pan-sexual

You are transgender or are transitioning genders
You have not or are in the process of figuring out your sexuality
You do not think of yourself as having a sexuality
You personally reject all labels of yourself
You made a mistake and did not mean to pick this answer
You mean something else (Go to 10c)

10aR) You did not enter an answer for the question. That is because:
You made a mistake and would like to answer
You do not know the answer
You do not want to answer

10b. [If don't know is selected] By <u>Don't Know</u>, do you mean that…
You don't understand the words
You understand the words, but you have not or are in the process of figuring out your sexuality
You mean something else

10bR) You did not enter an answer for the question. That is because:
You made a mistake and would like to answer
You do not know the answer
You do not want to answer

10c. [If you mean something else is selected]
What do you mean by something else?
Please type in your answer _____

Spanish Version (Versión en español)
Cognitive Interviewing Protocol
Updated: 6/8/11

Introduction to the Cognitive Interview:

Ahora, vamos a regresar al principio de la encuesta y hablar sobre cómo usted interpreto o entendió estas preguntas. Estoy interesada en saber que entendió usted se le estaba preguntando en las preguntas, como interpreto algunas palabras, y si las preguntas son difíciles de responder.

¿Tiene alguna otra pregunta? (Si no hay preguntas) OK, vamos a empezar.

1) Usted se considera ser…

Hombre
Mujer
Es más complicado (Go to 1a)

1R) No contestó la pregunta anterior. Es porque…
Usted se equivoco y quiere contestar la pregunta.
Usted no está seguro como contestar
Usted no quiere contestar la pregunta

1a) Cuando dice: <u>es más complicado,</u> quiere decir que…
Hombre, al nacer asignado como mujer
Mujer, al nacer asignado como hombre
Masculino, al nacer asignado como mujer
Femenina, al nacer asignado como hombre
Transgénero o géneroqueer, al nacer asignado mujer
Transgénero o géneroqueer, al nacer asignado hombre
Algo diferente
No quise elegir esta opción

1aR) No contestó la pregunta anterior. Es porque…
Usted se equivoco y quiere contestar la pregunta.
Usted no está seguro como contestar
Usted no quiere contestar la pregunta

1c) [If something else/Meant something else] ¿Qué quiere decir por algo diferente?
Por favor escriba su respuesta:
_____

2) Actualmente usted es….

Casado(a)
Viudo(a)
Divorciado(a)
Separado(a)
Nunca se ha casado
Viviendo con su pareja

2R) No contestó la pregunta anterior. Es porque…
Usted se equivoco y quiere contestar la pregunta.
Usted no está seguro como contestar
Usted no quiere contestar la pregunta

3) Está usted actualmente…

Trabajando con sueldo en un trabajo o negocio

Trabajando, pero sin sueldo, en un trabajo o negocio familiar
Con trabajo o negocio, pero no está trabajando, por ejemplo en baja por enfermedad
Buscando trabajo
No está trabajando y no está buscando empleo

3R) No contestó la pregunta anterior. Es porque…
Usted se equivoco y quiere contestar la pregunta.
Usted no está seguro como contestar
Usted no quiere contestar la pregunta

4) ¿Cual es el nivel más alto de educación que he asistio?
Nunca he asistido a la escuela
Escuela primaria (Go to 4a)
Escuela secundaria (Go to 4b)
Universidad o escuela técnica

4R) No contestó la pregunta anterior. Es porque…
Usted se equivoco y quiere contestar la pregunta.
Usted no está seguro como contestar
Usted no quiere contestar la pregunta

4a) ¿Cual es el nivel más alto de educación que a completado?
1˚grado (o equivalente)
2˚grado (o equivalente)
3˚grado (o equivalente)
4˚grado (o equivalente)
5˚grado (o equivalente)
6˚grado (o equivalente)
7˚grado (o equivalente)
8˚grado (o equivalente)

4aR) No contestó la pregunta anterior. Es porque…
Usted se equivoco y quiere contestar la pregunta.
Usted no está seguro como contestar
Usted no quiere contestar la pregunta

4b) ¿Cual es el nivel más alto de educación que he completado?
Graduado de escuela secundaria
GED o diploma general de educación
12˚grado, sin diploma
11˚grado (o equivalente)
10˚grado (o equivalente)
9˚grado (o equivalente)

4bR) No contestó la pregunta anterior. Es porque…
Usted se equivoco y quiere contestar la pregunta.
Usted no está seguro como contestar
Usted no quiere contestar la pregunta

4c) ¿Cual es el nivel más alto de educación que he completado?
Algunos años de universidad, sin título
Instituto Técnico: Programa técnico, vocacional, o profesional
Colegio Universitario: programa académica de dos años
Título universitario: Bachiller, pre-grado, licenciatura.
Maestría: MA, MS, MEng, MEd, MBA
Titulo de una escuela profesional: MD, DDS, DVM, JD

Doctorado: PhD, EdD

4cR) No contestó la pregunta anterior. Es porque…
Usted se equivoco y quiere contestar la pregunta.
Usted no está seguro como contestar
Usted no quiere contestar la pregunta

[Male Version]
5) Usted piensa en si mismo como…
Gay
no gay
Bisexual
Otra cosa [go to 5a]
No sabe [go to 5b]

5R) No contestó la pregunta anterior. Es porque…
Usted se equivoco y quiere contestar la pregunta.
Usted no está seguro como contestar
Usted no quiere contestar la pregunta

5a) Cuando dice, <u>No Sabe</u>, quiere decir que…
Usted es gay, pero se identifica más con otras clasificaciones como queer, multisexual, trisexual o andrógeno
Usted es transgénero o está en el proceso de transición de géneros
Usted no sabe o está en el proceso de descubrir su sexualidad
Usted no piense en sí mismo como teniendo una sexualidad
Rechaza personalmente todas las etiquetas para describir a su persona
Usted se equivoco y no quiso escoger esta respuesta
Usted quiere decir otra cosa [go to 5c]

5aR) No contestó la pregunta anterior. Es porque…
Usted se equivoco y quiere contestar la pregunta.
Usted no está seguro como contestar
Usted no quiere contestar la pregunta

5b) Cuando dice, <u>No Sabe</u>, quiere decir que…
Usted no entiende las palabras
Usted entiende las palabras, pero no sabe o está en el proceso de descubrir su sexualidad
Quiere decir otra cosa

5bR) No contestó la pregunta anterior. Es porque…
Usted se equivoco y quiere contestar la pregunta.
Usted no está seguro como contestar
Usted no quiere contestar la pregunta

5c) ¿Que quiere decir por <u>otra cosa</u>?
Por favor escriba su respuesta:
_____

Female Version
6) Usted piensa en sí mismo como…
Lesbiana o gay
no lesbiana o gay
Bisexual
Otra cosa [go to 6a]
No sabe [go to 6b]

6R) No contestó la pregunta anterior. Es porque…
Usted se equivoco y quiere contestar la pregunta.
Usted no está seguro como contestar
Usted no quiere contestar la pregunta

6a) Cuando dice <u>Otra Cosa,</u> quiere decir que…
Usted es lesbiana, pero se identifica más con otras clasificaciones como queer, multisexual, trisexual, o andrógina
Usted es transgénero o está en el proceso de transición de géneros
Usted no sabe o está en el proceso de descubrir su sexualidad
Usted no piense en sí mismo como teniendo una sexualidad
Rechaza personalmente todas las etiquetas para describir a su persona
Usted se equivoco y no quiso escoger esta respuesta
Usted quiere decir otra cosa [Go to 6c]

6aR) No contestó la pregunta anterior. Es porque…
Usted se equivoco y quiere contestar la pregunta.
Usted no está seguro como contestar
Usted no quiere contestar la pregunta

6b) Cuando dice <u>No Sabe</u>, quiere decir que…
Usted no entiende las palabras
Usted entiende las palabras, pero no sabe o está en el proceso de descubrir su sexualidad
Quiere decir otra cosa

6bR) No contestó la pregunta anterior. Es porque…
Usted se equivoco y quiere contestar la pregunta.
Usted no está seguro como contestar
Usted no quiere contestar la pregunta

6c) ¿Que quiere decir por <u>otra cosa</u>?
Por favor escriba su respuesta:
_____

7) ¿Cuántos años tiene usted? Escriba su edad usando los números en la computadora.
_____ Años

8) ¿Se considera de origen hispano o latino?
Si
No

8R) No contestó la pregunta anterior. Es porque…
Usted se equivoco y quiere contestar la pregunta.
Usted no está seguro como contestar
Usted no quiere contestar la pregunta

9) ¿A cuál raza o razas se considera pertenecer? Por favor elija 1 o más de una de estas categorías.
India americana o nativa de Alaska
Asiática
Negra o africana Americana
Nativo de Hawaii o Otra de las islas del Pacífico
Blanca
Alguna otra raza

9R) No contestó la pregunta anterior. Es porque…
Usted se equivoco y quiere contestar la pregunta.
Usted no está seguro como contestar
Usted no quiere contestar la pregunta

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